Area B. This volume represents an approximate depth of 6 inches over a length of approximately 200 feet. This material will be dewatered prior to removal off site for disposal. Areas B, C, D, F, and G will be subsequently filled to grade with clean backfill and/or topsoil, vegetated, and maintained as required. Area surface water drainage patterns will be modified as needed prior to construction to prevent erosion and/or runoff from entering the ditches. The areas will be returned to existing conditions subsequent to construction. The use of Area A will be restricted in the property deed.

As previously detailed in Section 5.5.1.1, the total volume of material to be excavated and transported is approximately 10,540 cubic yards. A summary of all excavation volumes and their development is provided in Table 4-6.

5.6.1.2 Technical Evaluation. This alternative is technically viable in all aspects for the facility conditions and corrective action objectives. Both excavation and off-site disposal are safe, effective, and reliable alternatives because the constituent source zones are removed. The useful life of this alternative is unlimited for the site areas, but would also be tied in with the disposal site's life. Implementability is not anticipated to be difficult due to the shallow depths requiring excavation. It is anticipated that the excavated material will be disposed at a landfill permitted to accept industrial waste and that such a landfill is available in the general area. Existing utilities could create implementation difficulties if field surveys identify any existing utilities within the vicinity of the excavations, as previously discussed in Section 5.5.1.

5.6.1.3 Environmental Evaluation. Excavation, backfill, and revegetation sufficiently achieves all environmental objectives at Areas B, C, D, F, and G. Removal of the constituent source zone is one of the more thorough corrective measure actions because the removal of the constituent material from the area effectively eliminates all environmental concerns at the site.

5.6.1.4 Human Health Evaluation. This combined excavation/off-site disposal alternative eliminates all identified short and long term human exposure pathways by eliminating the possibility of direct human contact with the material, eliminating the material's ability to be transported to an area of potential human contact via

erosive forces, and reducing the potential for constituent migration due to incident precipitation.

Short term health and safety issues identified with the implementation of this alternative are expected to be minimal, and include preventing exposure of the site worker, site remedial worker, and local residential population to fugitive dust and the unsafe operation of earthwork equipment and haul trucks. Additional issues with regard to off site disposal include highway related hazards due to increased truck traffic enroute to and from the disposal facility. Site controls such as erosion control measures will be implemented to prevent potential exposure from migration of surficial soil into surface water. Hazards associated with a potential spill incident are minimal since the material will be soil like in consistency and a spill would not result in widespread contamination, and the material has been shown to not be a significant health or environmental concern.

5.6.1.5 Institutional Evaluation. Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. The institutional concerns identified regarding this alternative include the location of a permitted off-site disposal facility, as well as any requirements for local building permits or soil/erosion plan approval.

5.6.1.6 Cost Evaluation. Capital and operation and maintenance costs for this alternative are estimated at $1,155,000 and $17,000, respectively.

5.6.2 Alternative 5B - Excavation of Areas B and C, and G; Off-Site Disposal; No Further Action at Areas D and F

5.6.2.1 Alternative Description. This alternative consists of the same components as described above for Alternative 5A, with the exception of corrective measures at Areas D and F. This alternative includes provision of No Further Action at Areas D and F. The use of Area A will be restricted in the property deed.

The total volume of material to be excavated and transported is approximately 7,850 cubic yards.

5.6.2.2 Technical Evaluation. This alternative is technically viable in all aspects for the facility conditions and corrective action objectives. Both excavation and off-site disposal are safe, effective, and reliable alternatives because the constituent source zones are removed. The useful life of this alternative is unlimited for the site areas, but would also be tied in with the disposal site's life. Implementability is not anticipated to be difficult due to the shallow depths requiring excavation. It is anticipated that the excavated material will be disposed at a landfill permitted to accept industrial waste and that such a landfill is available in the general area. Existing utilities could create implementation difficulties if field surveys identify any existing utilities within the vicinity of the excavations, as previously discussed in Section 5.5.1.

5.6.2.3 Environmental Evaluation. Excavation, backfill, and revegetation sufficiently achieves all environmental objectives at Areas B, C, and G. Removal of the constituent source zone effectively eliminates all environmental concerns due to the removal of the constituent material from the area. Because the affected soils at Area D are located approximately 3 feet below the ground surface, the measured levels in Areas D and F are only slightly above the USEPA action level, and the baseline risk assessment shows that all estimated risks for Areas D and F are within USEPA acceptable limits, no action at Areas D and F, in conjunction with excavation and off-site disposal of material from other site areas, sufficiently addresses environmental criteria. There are no adverse environmental effects associated with this alternative .

5.6.2.4 Human Health Evaluation. This combined excavation/off-site disposal alternative eliminates all identified short and long term human exposure pathways by eliminating the possibility of direct human contact with the material, eliminating the material's ability to be transported to an area of potential human contact via erosive forces, and reducing the potential for constituent migration due to incident precipitation.

Short term health and safety issues identified with the implementation of this alternative are expected to be minimal, and include preventing exposure of the site worker, site remedial worker, and local residential population to fugitive dust and the unsafe operation of earthwork equipment and haul trucks. Additional issues with regard to off site disposal include highway related hazards due to increased

truck traffic enroute to and from the disposal facility. Site controls such as erosion control measures will be implemented to prevent potential exposure from migration of surficial soil into surface water. Hazards associated with a potential spill incident are minimal since the material will be soil like in consistency and a spill would not result in widespread contamination, and the material has been shown to not be a significant health or environmental concern.

5.6.2.5 Institutional Evaluation. Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. The institutional concerns identified regarding this alternative includes the location of a permitted off-site disposal facility, as well as any requirements for local building permits or soil/erosion plan approval.

5.6.2.6 Cost Evaluation. Capital and operation and maintenance costs for this alternative are estimated at $855,000 and $17,000, respectively.

6.0 ANALYSIS OF CORRECTIVE MEASURE ALTERNATIVES

6.1 COMPARATIVE ANALYSIS OF ALTERNATIVES EVALUATED

In Section 3, corrective action objectives were established for the various site areas based upon the observed concentrations for constituents of interest compared to USEPA action levels. This comparison resulted in the need to address surficial and/or shallow soils in Areas B, C, D, F, and G. In Section 4, general response actions were established for the site areas and media of interest. Based on the findings and conclusions of previous studies and the knowledge of existing site use and operations, the technology identification and screening process was relatively straightforward and resulted in the assembly of ten remedial alternatives.

A detailed evaluation of the ten assembled corrective measure alternatives was conducted in Section 5, as required by Task II of the USEPA Scope of Work, taking into account site specific conditions. The detailed analysis included a description of how each alternative could be implemented for the specific site area and an evaluation of each alternative using specific evaluation criteria, including technical, human health, environmental, and institutional factors. The assembled alternatives consist of the following:

- Alternative 1 - No Further Action
- Alternative 2 - Limited Institutional Action
- Alternative 3 - Source Containment
- Alternative 4 - Excavation and On Site Disposal
  - 4A - Excavation of Areas B and C, D, F, and G; Disposal at Area A
  - 4B - Excavation of Areas B and C, F, and G; Disposal at Area A; No Further Action at D
  - 4C - Excavation of Areas B and C, and F; Disposal at Area G; No Further Action at Area D
  - 4D - Excavation of Area F; Disposal at Area G; Source Containment at Areas B, C, and D

4E - Excavation of Areas B and C, and G; Disposal at Area A; No Further Action at Areas D and F.

- Alternative 5 - Excavation and Off Site Disposal
  5A - Excavation of Areas B and C, D, F, and G; Off Site Disposal
  5B - Excavation of Areas B and C, and G; Off Site Disposal; No Further Action at D and F

A summary of the detailed evaluation performed in Section 5 is provided for all alternatives in Table 6-1. This table summarizes evaluation criteria and findings for all alternatives, in terms of the following:

- Technical - Performance, reliability, implementability, and safety criteria.

- Environmental - Short and long term effects with respect to any potential migration pathways.

- Human Health - Short and long term level of exposure to residual concentrations and reduction over time.

- Institutional - Public health standards, regulations, guidances, advisories, ordinances, and community relations.

The components of these criteria are discussed in greater detail in Section 5.1. The ability of an assembled alternative to be protective of human health (Section 2) and to meet corrective action objectives (Section 3) was discussed in Section 5.

Based on the revised HEA and Baseline Risk Assessment, the risk of exposure to human health and the environment is not considered to be a concern. In general, the No Further Action and the Limited Institutional Action assembled alternatives are not as protective of public health as other alternatives since they do not reduce the potential for direct contact and they do not meet the corrective action objective of constituent mobility reduction via erosion and infiltration. However, No Further Action may be appropriate for certain areas, particularly because some measures applicable to site remedies are currently in place, such as site security, surface water management, and general site maintenance. In addition, as discussed in

TABLE 6-1
INDIVIDUAL SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Evaluation Criteria			
Technical	Environmental	Human Health	Institutional
Alternative 1 - No Further Action			
Limited effectiveness in areas of surficial contamination. Implementability, reliability, and safety are not relevant to this option except for continued site security and maintenance operations. Short-term effectiveness and long-term reliability for protection of human health and the environment are adequate in Area D. Useful life is unlimited with continued maintenance.	Area D is considered to be a low risk area due to an overlying layer of soil, which sufficiently eliminates the potential constituent migration pathway via erosive forces. There are no beneficial effects to this alternative for areas with surficial soil contamination. However, adverse effects are minimal.	Area D is considered to be a low risk area due to an overlying layer of soil, which sufficiently eliminates exposure pathway to direct human contact. The potential for exposure in other than an industrial setting is not a concern. Only minimal reduction of constituent concentrations over time is expected.	None identified.
Alternative 2 - Limited Institutional Action			
Reliable and effective in the short-term for the protection of human health and the environment. Long-term reliability and safety will be dependent upon deed restrictions regarding site use and long term maintenance requirements. The time required to implement and realize the benefits of this alternative are minimal. Useful life is unlimited with continued maintenance.	Long and short term benefits are effectively the same as for Alternative 1. Deed restrictions provide long term protection.	The facility areas are considered to pose little or no risk to human health. Only minimal reduction of constituent concentrations over time is expected.	Local building permits or local soil/erosion plan approval may be required. Land use restrictions required for all site areas.
Alternative 3 - Source Containment			
Performance, effectiveness, and reliability are adequate for the short term protection of human health and the environment. Easily implementable, safe, and cost-effective remedy when combined with continued site maintenance, stormwater management, and security. Useful life is unlimited with continued site maintenance. Implementation time is minimal.	Some reduction in constituent mobility, reduces migration pathways associated with erosive forces and infiltration. Overall surface water quality is anticipated to improve by reduction in sediment transport associated with erosion. Does not address transport of constituents already in sediment. Long term environmental benefits are dependent upon long term site maintenance and security.	Long and short term exposure potential sufficiently reduced. Direct exposure pathway eliminated. Constituent reduction over time is expected to be minimal.	Local building permits or local soil/erosion plan approval may be required. Land use restrictions required for all site areas.

TABLE 6-1 (Continued)
INDIVIDUAL SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Evaluation Criteria			
Technical	Environmental	Human Health	Institutional
Alternative 4A - Excavation of Areas B and C, D, F, and G; Disposal at Area A			
Technically feasible in all criteria aspects. Erosion, runoff, and constituent migration due to infiltration and percolation virtually eliminated. Easily implemented. Use of existing on site disposal area improves implementability and maximizes facility land use by eliminating the need to dedicate "new" space for on site placement. Existing utilities (Area D) may create excavation implementation difficulties. O&M requirements are not significantly different than existing. Useful life is indefinite with proper maintenance.	No adverse short or long-term environmental effects are evident. Constituent migration via erosive forces eliminated, by removal and consolidation of material. Potential for constituent transport in sediment in Area B ditch also eliminated by removal of constituent. No migration pathways are associated with placement and capping of material at Area A. These beneficial affects would be realized immediately. Surface water quality is anticipated to improve almost immediately. Minimal environmental risk associated with Area D does not warrant excavation.	Short and long-term direct human exposure pathways are eliminated. Indirect pathways resulting from erosion/sediment transport and constituent migration are also eliminated. Constituent reduction over time is expected to be minimal.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions only required for Area A.
Alternative 4B - Excavation of Areas B and C, F, and G; Disposal at Area A; No Further Action at Area D			
Technically feasible in all evaluation criteria aspects. Elimination of deeper excavation at Area D improves implementability. Erosion, runoff, and constituent migration due to infiltration and percolation virtually eliminated. Use of existing on site disposal area improves implementability and maximizes facility land use by eliminating the need to dedicate "new" space for on site placement. Possible existence of utilities (Area G) may decrease implementability of this alternative by causing difficulty in excavation. Operation and maintenance requirements are not significantly greater than existing. No Further Action at Area D reduces potential problems associated with utilities in Area D and reduces volumes handled. Useful life is indefinite with proper maintenance.	No adverse short or long-term environmental effects are evident for this alternative. Erosion, runoff, and constituent migration pathways are eliminated by removal of material. Surface water quality is anticipated to improve almost immediately. Beneficial effects are realized immediately.	Short and long-term direct human exposure pathways are eliminated. Indirect pathways associated with erosion/sediment transport and constituent migration are also eliminated. Constituent reduction over time is expected to be minimal.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions required for Area A.

TABLE 6-1 (Continued)
INDIVIDUAL SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Evaluation Criteria			
Technical	Environmental	Human Health	Institutional
Alternative 4C - Excavation of Areas B and C, and F; Disposal at Area G; No Further Action at Area D			
Technically feasible for all evaluation criteria aspects. Erosion, runoff, and sediment constituent pathways virtually eliminated. Easily implemented. No Further Action at Area D and on site placement and capping at Area G greatly reduce excavation depths and volumes, potential utility conflicts, and cost and improves implementability. Existence of on site Area G for placement improves alternative implementability. Operation and maintenance requirements are not significantly greater than those existing. Useful life is indefinite with proper maintenance.	No adverse short or long-term environmental effects are evident. Erosion, runoff, and constituent migration pathways are eliminated. No migration pathways are associated with consolidation and placement of Area G. Surface water quality is anticipated to improve almost immediately. Beneficial affects will be realized immediately.	Short and long-term direct human exposure pathways eliminated. Indirect pathways associated with erosion/sediment transport and constituent migration are also eliminated. Constituent reduction over time is expected to be minimal.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions required for Areas A and G.
Alternative 4D - Excavation of Area F; Disposal at Area G; Source Containment at Areas B and C, and D			
Performance, effectiveness, reliability, and safety of source containment areas are adequate for the short and long-term protection of human health and the environment. Increased difficulty in implementability associated with placement of cap and associated rise in grade elevations as compared to Alternative 3. Easily implemented. Excavation and on site placement of Area F and capping of Area G is technically feasible in all criteria aspects. Erosion, runoff, and constituent migration due to infiltration and percolation virtually eliminated. Use of existing on site Area G for placement improves implementability and facility land use and greatly reduces excavation volume. Easily implemented. Existing utilities at Area D may increase excavation implementation difficulties. Useful life is indefinite with proper maintenance.	No adverse short or long-term environmental effects are evident. Constituent mobility via erosive forces and infiltration are eliminated. Direct contact pathway eliminated. Potential for constituent transport in sediment in Area B ditch also eliminated by removal of constituent. Surface water quality is anticipated to improve almost immediately. Beneficial effects would be short and long-term and realized almost immediately.	Short and long-term direct exposure pathways to humans are substantially minimized. Indirect pathways resulting from erosion/sediment transport and constituent migration are also eliminated. Constituent reduction over time is expected to be minimal.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions required for all site areas, except Area F.

TABLE 6-1 (Continued)
INDIVIDUAL SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Evaluation Criteria			
Technical	Environmental	Human Health	Institutional
Alternative 4E - Excavation of Areas B and C, and G; Disposal at Area A; No Further Action at Areas D and F			
Technically feasible in all evaluation criteria aspects. Erosion, runoff, and constituent migration due to infiltration and percolation virtually eliminated. Use of existing on site disposal area improves implementability and maximizes facility land use by eliminating the need to dedicate "new" space for on site placement. Possible existence of utilities (Area G) may decrease implementability of this alternative by causing difficulty in excavation. Operation and maintenance requirements are not significantly greater than existing. No Further Action at Area D reduces potential problems associated with utilities in Area D and reduces volumes handled. Useful life is indefinite with proper maintenance.	No adverse short or long-term environmental effects are evident for this alternative. Erosion, runoff, and constituent migration pathways are eliminated by removal of material. Surface water quality is anticipated to improve almost immediately. Beneficial effects are realized immediately.	Short and long-term direct human exposure pathways are eliminated. Indirect pathways associated with erosion/sediment transport and constituent migration are also eliminated. Constituent reduction over time is expected to be minimal.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions required for Area A.
Alternative 5A - Excavation of Areas B and C, D, F, and G; Off Site Disposal			
Technically feasible in all aspects of evaluation criteria. Easily implemented. Although excavation depths are shallow, utility conflicts may increase implementation difficulty. Existence of on site haul roads improves implementability. Long-term liabilities are associated with off site disposal. Useful life unlimited but tied into off site facility.	No adverse short or long-term environmental effects are evident. Material removal is more thorough but unwarranted for risk. Erosion, runoff, and constituent migration pathways are eliminated. Surface water quality is anticipated to improve almost immediately. Beneficial effects will be realized immediately. Minimal environmental risk associated with Area D does not warrant excavation.	Short and long-term direct human exposure pathways eliminated. Indirect pathways associated with erosion/sediment transport and constituent migration also eliminated.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions required for Area A only.

TABLE 6-1 (Continued)
INDIVIDUAL SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Evaluation Criteria			
Technical	Environmental	Human Health	Institutional
Alternative 5B - Excavation of Areas B and C, and G; Off Site Disposal; No Further Action at Areas D and F			
Technically feasible in all aspects of evaluation criteria. Erosion, runoff, and constituent migration pathways are eliminated. Easily implemented. Existence of on site haul roads improves implementability. O&M requirements are not significant. No Further Action at D and F reduces excavation depth and disposal volume associated with this technology, as well as potential utility problems in Area D. Long-term liabilities are associated with off site disposal. Useful life is indefinite, but tied into off site facility.	No adverse short or long-term environmental effects are evident. Erosion, runoff, and constituent migration pathways are eliminated. Surface water quality is anticipated to improve almost immediately. Beneficial effects will be realized immediately.	Short and long-term direct human exposure pathways eliminated. Indirect pathways associated with erosion/sediment transport and constituent migration also eliminated. Constituent reduction over time at Area D and F is expected to be minimal.	Local building permit or local soil/erosion plan approval may be required. Land use restrictions required for Area A.

Sections 5.2 through 5.6, the assembled alternatives meet corrective action objectives to varying degrees. Alternatives 3, 4, and 5, however, are protective of human health and meet all of the corrective action objectives identified in Section 3, which include:

- The protection of human health and the environment.
- Control of the sources of release so as to reduce or eliminate, to the maximum extent practical, further releases.
- Compliance with applicable standards for the management of wastes.
- Attainment of media cleanup standards, as appropriate.

A comparative analysis is performed in this section of nine alternatives (excluding the No Further Action Baseline Alternative), which were evaluated in detail in Section 5. Based on this comparative analysis, a corrective measure alternative is recommended for implementation, as required by Task III of the USEPA Scope of Work.

The following evaluation criteria have been used to comparatively evaluate the alternatives.

- Long term reliability and effectiveness
- Reduction of mobility, toxicity, or volume of waste
- Short term effectiveness
- Implementability
- Cost

These criteria are used to highlight the beneficial and adverse tradeoffs associated with one alternative over another. This comparison allows for the identification of the more attractive alternatives. These remaining alternatives were evaluated based upon site specific considerations and the extent to which they address USEPA action levels, and a single alternative has been recommended to the USEPA for implementation.

The comparative analysis of alternatives is summarized in Table 6-2 and is described below, with the exception of cost. Capital, O&M, and total present worth costs are summarized separately in Table 6-3.

6.1.1 Long Term Reliability and Effectiveness

Long term reliability and effectiveness is a decision factor which evaluates the appropriateness of an alternative based upon its ability to achieve intended functions, such as meet media clean up standards, in the short term, while not creating greater or future risks which may necessitate future corrective action. This factor also considers the complexity of the O&M and the potential effect of failure.

The No Further Action alternative does not sufficiently address the long term reliability requirements because the potential for future exposure still exists due to unrestricted use of an area and because areas have not been covered or excavated. No Further Action is carried forward for baseline comparison and only sufficiently meets the requirements for long term reliability and effectiveness in Areas D and F. Area D exhibits shallow soil contamination only (not surficial) and, as it exists, is effectively capped by approximately three feet of existing soil. Analytical results for soil borings and surface soil samples from Area F show it contain among the lowest concentrations of the constituents of interest compared to the other SWMUs. Factors in addition to low constituent concentrations include its small volume and the fact that it is partially covered by roads and buildings. Leaving soil at Areas D and F in place sufficiently achieves clean up goals in the short term and does not create a greater future risk that would require corrective action at some point in the future.

Alternative 2 provides improved effectiveness by implementation of land use restrictions for all of the site areas of interest. However, it does not address potential constituent migration or transport. Alternative 3 also provides for further improved effectiveness in reduction of constituent transport via erosive forces, but does not address migration and is not as protective as Alternatives 4 and 5. Alternatives 3 and 4D satisfy short term objectives by eliminating direct human and environmental exposure pathways and, with appropriate deed restrictions and maintenance requirements in place, will not require potential future corrective measures.

TABLE 6-2

COMPARATIVE SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Comparative Criteria			
Long Term Reliability and Effectiveness	Reduction of Constituent Mobility, Toxicity, or Volume	Short Term Effectiveness	Implementability
Alternative 1 - No Further Action			
Baseline for comparison. Does not reduce any potential for exposure.	Baseline for comparison. Does not reduce any potential constituent mobility, toxicity, or volume.	Baseline for comparison. Human health and environmental impacts determined to not be a concern outside industrial setting.	Baseline for comparison.
Alternative 2 - Limited Institutional Action			
Long term reliability improved over No Further Action due to land use restrictions. Effectiveness is only minimally improved over No Further Action.	Does not reduce any potential constituent mobility, toxicity, or volume.	Minimally effective over the short term by elimination of direct exposure pathway.	Easily implemented.
Alternative 3 - Source Containment			
Improved over Limited Institutional Action. No additional O&M required.	Constituent mobility due to erosive forces reduced over Limited Institutional Action in areas with surficial contamination. Does not address constituent toxicity or volume. Does not address constituent transport in sediment.	Effective for the protection of human health and the environment. Improved over Limited Institutional Action.	Implementability is greater for this option than for Alternatives 4 and 5 due to simplicity of action. Minimal implementation time.
Alternative 4A - Excavation of Areas B and C, D, F, and G; Disposal at Area A			
Excavation and consolidation of constituent material at Area A is a more thorough, effective, and safe response compared to Alternative 3B because all maintenance efforts for the useful life of the cap are focused on one area. Consolidation/ on site disposal is an improved land use/management scenario. Excavation of Area D is not necessary to meet the corrective action objectives. Only Area A requires land use restrictions.	Potential constituent mobility is reduced substantially over containment alternatives because excavated material is consolidated at Area A and all other SWMUs targeted for action are eliminated. Excavation of Area D does not significantly reduce constituent mobility over Alternatives 1, 2, and 3. Does not address constituent toxicity or volume.	Not substantially different from that of capping each individual area, but improved over Alternatives 1 and 2.	Standard materials, equipment, and construction techniques are applicable, and excavation depths are relatively shallow. However, implementability is more complex than containment due to excavation, backfill, and placement requirements. Existing underground utilities may increase implementation difficulty over containment alternatives. Implementation time increased over containment alternative.

TABLE 6-2 (Continued)

COMPARATIVE SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Comparative Criteria			
Long Term Reliability and Effectiveness	Reduction of Constituent Mobility, Toxicity, or Volume	Short Term Effectiveness	Implementability
Alternative 4B - Excavation of Areas B and C, F, and G; Disposal at Area A; No Further Action at Area D			
See Alternative 4A. No Further Action at D does not affect the overall effectiveness of the option. Requires land use restrictions at Area A.	See Alternative 4A, first paragraph. The risk of constituent mobility at Area D does not warrant corrective action because the constituent source zone is in shallow soil and virtually immobile. Does not address constituent toxicity or volume.	Comparable to Alternative 4A.	See Alternative 4A. Improved over Alternative 4A because deeper excavations at Area D are not a component of this alternative. Implementation time decreased from Alternative 4A.
Alternative 4C - Excavation of Areas B and C, F; Disposal at Area G; No Further Action at Area D			
Comparable to Alternatives 3B, 4A, and 4B. No Further Action at D and soil placement at Area G do not lend to increased effectiveness over Alternative 4A or 4B. Placement at Area G increases number of areas to be maintained and to which deed restrictions would apply compared to Alternatives 4A and 4B.	See Alternative 4A, first paragraph. Constituent mobility is significantly reduced compared to containment alternatives because excavated material is consolidated at Area G and all other SWMUs targeted for action are eliminated. See Alternative 4B, second paragraph. Does not address constituent toxicity or volume.	Comparable to Alternative 4A.	See Alternative 4A. Lack of deep (1 to 6 foot) excavations in Areas D and G greatly improve implementability over previously examined alternatives. Also improved because surface area of Area G is smaller than that of A. Implementation time decreased from Alternative 4A.
Alternative 4D - Excavation of Area F; Disposal at Area G; Source Containment at Areas B and C, D			
Improved over Alternative 3. Excavation of Area F and placement at Area G provides for a more effective response due to improved land use/management. Land use restrictions required for all site areas, except Area F. Number of areas to be maintained and to which deed restrictions would apply is increased over Alternative 4.	Potential mobility of constituents is reduced as compared to Alternative 3 provided the integrity of the cover system is maintained on a long-term basis. Mobility reduction is comparable to Alternatives 4A, 4B, 4C, and 5. Does not address constituent toxicity.	Improved over Alternative 3. Comparable to Alternative 4A.	More difficult than Alternative 3 due to the number of areas to cover. Will require more time for implementation than Alternatives 1, 2, and 3. Standard materials, equipment, and construction techniques are applicable, and excavation depths are relatively shallow.

TABLE 6-2 (Continued)

COMPARATIVE SUMMARY OF CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Comparative Criteria			
Long Term Reliability and Effectiveness	Reduction of Constituent Mobility, Toxicity, or Volume	Short Term Effectiveness	Implementability
Alternative 4E - Excavation of Areas B and C, and G; Disposal at Area A; No Further Action at Areas D and F			
See Alternative 4A. No Further Action at D and F does not affect the overall effectiveness of the option. Requires land use restrictions at Area A.	See Alternative 4A, first paragraph. The risk of constituent mobility at Areas D and F does not warrant corrective action because the constituent source zone is in shallow soil and virtually immobile. Does not address constituent toxicity or volume.	Comparable to Alternative 4A.	See Alternative 4A. Improved over Alternative 4A because deeper excavations at Area D are not a component of this alternative. Implementation time decreased from Alternative 4A.
Alternative 5A - Excavation of Areas B and C, D, F, and G; Off Site Disposal			
Potentially improved over other alternatives, as long as off site facility is properly operated and maintained, because affected material is removed from the site areas. However, management procedures are already in place at the site which would likely be as good or better than at an off site facility. Some control lost by transferring material to off site facility. Would still require on site land use restrictions.	Constituent mobility is eliminated. However, material removal does not provide substantial reduction in constituent toxicity, mobility, or volume over on site disposal. Does not address constituent toxicity or volume.	Off site disposal substantially increases potential for off site exposure for the duration of implementation.	See Alternative 4A, first paragraph. Less complex than Alternative 4 because on site placement and capping components are eliminated. About the same implementation time as Alternative 4. May require further material characterization for off site disposal. Contingent upon availability of landfill space.
Alternative 5B - Excavation of Areas B and C, and G; Off Site Disposal; No Further Action at Areas D and F			
See Alternative 5A.	See Alternative 5A. The risk of constituent mobility at Area D does not warrant corrective action because the constituent source zone is shallow soil and virtually immobile. Does not address constituent toxicity or volume.	See Alternative 5A.	See Alternative 4A, first paragraph. See Alternative 5A. Potential utility conflicts in Area D are eliminated. Slight decrease in implementation time from Alternative 5A.

TABLE 6-3

COMPARATIVE COST ANALYSIS

RMI SODIUM FACILITY
ASHTABULA, OHIO

	Costs (1993 $)		
	Capital	Annual O & M	Present Worth[a]
Alternative 1 - No Further Action	0	0	0
Alternative 2 - Limited Institutional Action	10,000	10,000	105,000
Alternative 3 - Source Containment	103,000	17,000	265,000
Alternative 4 - Excavation and On Site Disposal			
4A Excavation of Areas B and C, D, F, and G; Disposal at A			
Option 1 - Soil Cover System	589,000	23,000	805,000
Option 2 - Geomembrane Cover System	800,000	23,000	1,020,000
4B Excavation of Areas B and C, F, and G; Disposal at A; No Further Action at D			
Option 1 - Soil Cover System	520,000	23,000	740,000
Option 2 - Geomembrane Cover System	750,000	23,000	970,000
4C Excavation of Areas B and C, and F; Disposal at G; No Further Action at D			
Option 1 - Soil Cover System	202,000	19,000	380,000
Option 2 - Geomembrane Cover System	260,000	19,000	440,000
4D Excavation of Area F; Disposal at Area G; Source Containment at Areas B, C, D			
Option 1 - Soil Cover System	292,000	19,000	470,000
Option 2 - Geomembrane Cover System	464,000	19,000	645,000
4E Excavation of Areas B, C, and G: Disposal at Area A; No Further Action at D and F			
Option 1 - Soil Cover System	494,000	19,000	675,000
Option 2 - Geomembrane Cover System	706,000	19,000	885,000
Alternative 5 - Excavation and Off Site Disposal			
5A Excavation of Areas B and C, D, F, and G; Off Site Disposal	1,155,000	17,000	1,315,000
5B Excavation of Areas B and C, and G; Off Site Disposal; No Further Action at D and F	855,000	17,000	1,015,000

[a]Present worth is the result of a 30-year analysis period. All capital costs were assumed to be incurred for year 0 of the analysis, while operation and maintenance costs were assumed for years 1 through 30. A discount rate of 10 percent was assumed for this analysis. Source: *Engineering Economy*; Prentice-Hall, Inc., New Jersey; 5th Edition, 1977.

Alternatives 4A, 4B, 4C, 4E and 5 all exhibit exceptional long term reliability and effectiveness because the direct exposure pathways for human and environmental contact are eliminated by removal and consolidation of the affected material. Long term reliability and effectiveness are achieved for all of these alternatives. However, off site disposal in a commercial facility would not necessarily improve long term reliability. The waste material is currently at an industrial facility which is familiar with managing waste materials. Therefore, long term reliability and effectiveness provided by remedy implementation by the RMI facility would likely be as good, if not better, than at an off site facility. In addition, many of the environmental protection features associated with a landfill are already in place at the site, including site security, monitoring wells, and an O&M program. Disposal at either Area A or G, with deed restrictions, also satisfies the requirements for long term effectiveness and reliability. In addition, it provides improved land management. Lastly, the reliability of all of the alternatives is relatively equal with respect to continued O&M since those requirements would not be substantially different than existing site O&M procedures.

In summary, long term reliability and effectiveness are adequately provided by Alternative 4 and Alternative 5. However, considering existing site conditions and management procedures already in place, the alternatives most appropriate for implementation at the RMI facility are Alternatives 4A, 4B, 4C, and 4E.

6.1.2 Reduction of Mobility, Toxicity, or Volume of Waste

Reduction in mobility, toxicity, or volume are particularly valuable in circumstances in which the constituents of interest may degrade into more hazardous or toxic products or fail to attenuate naturally. However, toxicity reduction is not an appropriate consideration for this facility because the constituents present in the affected material are not at toxic levels, as discussed in Section 2. For this site, reduction of waste mobility and volume is best represented by the excavation Alternatives 4 and 5. Mobility is addressed by these alternatives by capping the affected material, while volume is addressed by consolidation of the material. None of the alternatives provides for reduction of constituent volume. Alternatives 1 and 2 do not address potential constituent mobility at all, and Alternative 3 only minimally reduces the constituent mobility via erosion and infiltration pathways.

In addition, Alternatives 1, 2, and 3 do not address constituent transport in the drainage ditch sediment. Alternative 4D does contribute substantially to the reduction of constituent mobility by eliminating the potential constituent migration pathway due to infiltration and erosion. But, this alternative contributes only minimally to waste reduction via consolidation. Alternatives 4A, 4B, 4C, 4E, and 5, however, reduce constituent mobility and provide for waste consolidation at the site by the removal of the affected material from the site areas. Alternatives 4 and 5 sufficiently satisfy the reduction of mobility criterion. However, the excavation of Areas D and F do not substantially reduce constituent mobility over Alternatives 1, 2, and 3. There is no substantial difference realized by disposal at Area A, G, or at an off site location with respect to the reduction of constituent mobility or volume.

Alternatives 3 and 4 reduce constituent mobility; however, the low permeability cover proposed in Alternative 4 is substantially more effective than the vegetative cover proposed in Alternative 3, which only minimally reduces potential constituent migration. In addition, while it does not reduce constituent volumes, Alternative 4 provides for consolidation of affected material. Alternative 5 also does not reduce constituent volume, but does address removal of the affected material from the site. However, since the affected material is located on an industrial facility which is familiar with management of such materials and has essential procedures already in place, no substantial reduction in mobility, toxicity, or volume would be realized by off site disposal. Therefore, reduction of mobility, toxicity, or volume of waste is best provided by Alternatives 4A, 4B, 4C, and 4E.

6.1.3 Short Term Effectiveness

Short term effectiveness is concerned with the ability of the assembled alternative to be protective of human health and the environment during the short term, while also reducing long term risks.

Because the potential risk to human health and the environment has been shown to not be a concern, short term effectiveness is suitably addressed by all of the assembled alternatives, although the reduction of potential long term risk is not specifically addressed by the No Further Action and Limited Institutional Action alternatives. The revegetation alternative improves short term effectiveness, but does not provide the level of protection afforded by Alternatives 4 and 5. As

previously discussed in Section 6.1.2, the reduction of long term risks are sufficiently addressed by Excavation and On Site or Off Site Disposal. However, transport of material to an off site facility would increase potential for off site exposure during implementation of the corrective measures. Therefore, Alternative 5 would involve unnecessary risk and not provide substantial additional benefits.

As such, the options of Alternative 4 - Excavation and On Site Disposal are considered to best demonstrate relatively similar and acceptable short term effectiveness.

6.1.4 Implementability

Implementability is primarily concerned with the ease of construction and operation, including any requirements for innovative construction techniques or materials. Time required to achieve a given level of response is also considered and includes two components - implementation time and time required to see beneficial results.

Because the technologies are all proven and easily implemented, implementability is relatively comparable for all alternatives. However, site conditions may render some alternatives more difficult to implement than others. For instance, the deeper excavations required in Areas D and G may result in potential utility conflict, and thus, increased alternative implementation difficulty. The surficial excavation options addressed by Alternatives 4C and 4D are, therefore, potentially more easily implemented because surficial excavations are only required, and are less likely to result in a utility conflict than those options which require the excavation of Areas D and G. Alternative 4D may provide more implementation difficulty than 4A, 4B, 4C, or 4E due to the additional construction of a cover system and with the increased detailed construction of the cap required in more areas, including areas through which RMI personnel more frequently travel, such as Area F. Alternatives 4A, 4B, 4E, and 5 are the only alternatives which do not require the implementation of a deed restriction beyond that for Area A.

The relative timing of each alternative is anticipated to be generally within a 6 month time period, with No Further Action requiring less time than Limited

Institutional Action which would, in turn, require less time than Containment. Excavation and On Site Disposal or Excavation and Off Site Disposal would require about the same implementation time, although it would be somewhat greater than for other alternatives. In general, however, all alternatives are easily and readily implementable with standard materials, construction techniques and equipment, and transportation equipment.

As such, the following alternatives appear to demonstrate the best implementability:

- Alternative 1 - No Further Action
- Alternative 2 - Limited Institutional Action
- Alternative 3 - Source Containment
- Alternative 4C - Excavation of Areas B and C, and F; Disposal at Area G; No Further Action at Area D
- Alternative 4E - Excavation of Areas B, C, and G; Disposal at Area A; No Further Action at Areas D and F.

6.1.5 Cost

Based upon the relative similarity in technologies for Alternatives 3, 4, and 5, the weight attributable to alternative advantages and disadvantages is relatively equal. Although cost is not typically considered to be a predominant criteria for selection of an alternative over the protection of the health and environment, cost benefit is considered to be an important factor in the selection of the proposed alternative for the RMI facility since protection of human health and the environment has been determined during the HEA (Section 2) to not be a concern. Cost estimates include both capital and O&M costs. Capital costs estimates have addressed both direct and indirect costs, while O&M cost estimates include both labor, material, and services costs. Comparative present worth values of each assembled alternative are summarized in Table 6-3.

For comparable environmental benefit, the excavation and off site disposal costs are higher than other acceptable alternatives with equal technical and environmental benefit. Off site disposal also potentially exposes RMI to liability associated with past, current, and/or future disposal and maintenance practices at the off site facility. Because of the media (surficial and shallow soils) and the extent and nature of the constituents in that media at the facility, off site disposal is not considered to provide adequate additional protection with respect to the increased costs. The base present worth costs for Alternatives 4A, 4B, 4C, 4D, and 4E are less expensive than off site disposal option. The increase in off site disposal costs are attributable to the transportation and disposal fees associated with off site disposal in a permitted facility. In addition, as discussed previously, off site disposal provides no substantial increase in long term reliability or effectiveness; does not provide a substantial decrease in constituent mobility, toxicity, or volume over other alternatives; reflects an increased short term exposure risk; and reduces the reliability of controlling the affected material.

Comparison of the relative present worth of Alternatives 4A, 4B, 4C, 4D, and 4E indicates that Alternative 4C is the corrective measure of least cost with a present worth of $380,000 or $440,000, depending on the cover system. The primary value of this alternative option is attributable to the fact that on site disposal takes place at Area G and, therefore, preparation and revegetation of Area A does not factor into the overall capital cost of the remedy, nor does Area G require excavation to satisfy the corrective action objectives for the facility. The least expensive off site disposal option is Alternative 5B, which has a present worth of $1,015,000.

6.2 FINAL SCREENING OF CORRECTIVE MEASURE ALTERNATIVES

In light of the remedy selection criteria for long term reliability and effectiveness; reduction of mobility, toxicity, or volume of waste; short term effectiveness; implementability; and cost, the following alternatives are among the preferred candidates:

- Alternative 1 - No Further Action (Base Comparison)
- Alternative 4B - Excavation of Areas B and C, F, and G; Disposal at Area A; No Further Action at Area D

- Alternative 4C - Excavation of Areas B and C, and F; Disposal at Area G; No Further Action at Area D
- Alternative 4D - Excavation of Area F; Disposal at Area G; Source Containment at Areas B and C, D
- Alternative 4E - Excavation of Areas B, C and G; Disposal at Area A; No Further Action at Areas D and F.

Alternative 1 has been discussed as a baseline for comparison. However, as summarized in Section 5.2, Alternative 1 does not meet site Corrective Action Objectives, with the exception of Area D. Therefore, Alternative 1 is not considered to be a viable remedy. Additionally, Alternatives 4B, 4C, and 4E provide more environmental benefit than 4D which has a cost greater than Alternative 4C but less than 4B and 4E. Therefore, Alternative 4D is not considered further.

Alternatives 4B, 4C, and 4E are acceptable alternatives with respect to technical performance, reliability, safety, and implementability; human health and environmental exposure pathways are eliminated; and no significant institutional concerns are identified. Each are protective of human health and eliminate the potential exposure pathway to humans via direct contact, as well as being alternatives which meet the corrective action objectives associated with this corrective measure study. Additionally, each of the alternatives address all area specific USEPA action levels via excavation, consolidation, and capping. These alternatives, which include No Further Action at Area D, also address the action levels for that area since there is no surficial contamination at Area D and constituent migration has been determined to not be a concern. No Further Action at Area F (Alternative 4E) does not pose a problem since the estimated risks for Area F are within acceptable USEPA limits. Each alternative is equally reliable and effective in both the long and short term potential for risk and for the potential need for future corrective measures. Alternative 4C is the more easily implementable alternative and also has the lower present worth. Alternative 4B provides the most waste consolidation.

Alternative 4C satisfies all of the corrective action objectives and addresses all of the action levels, while eliminating the need for extensive site preparation and revegetation at Area A, as well as eliminating the need for deeper (up to 6.5 feet) excavations at Area D and Area G with the potential for some utility conflict during

remedial efforts. Alternative 4B also satisfies all of the corrective action objectives and addresses all of the action levels. In addition, Alternative 4B provides the substantial benefit of consolidating affected material into a single area, thereby simplifying O&M requirements, allowing for better management and control of the material, and allowing the use of all other site areas. Lastly, Alternative 4E also satisfies all of the corrective action objectives and addresses all of the action levels. The substantial benefit of consolidating affected material into a single area is improved for Alternative 4E over 4C, but not 4B. However, No Further Action at Area F would not pose any problems since the baseline risk assessment has shown that potential risks associated with Area F are within USEPA acceptable limits. Alternative 4C is the least expensive, but 4E offers consolidation of affected material at a cost lower then 4B. As such, Alternative 4E is the recommended corrective measure alternative.

6.3 DESCRIPTION OF THE RECOMMENDED ALTERNATIVE

The individual and comparative evaluation of the assembled alternatives have resulted in the recommendation of Option 1 of Alternative 4E (Excavation of Areas B and C, and G; Disposal at Area A; No Further Action at Areas D and F) as the corrective measure alternative for the RMI Sodium facility. This selection has been based upon the evaluation criteria of technical factors, environmental effects, human exposure, and institutional considerations and the comparative criteria of long term reliability and effectiveness; reduction of mobility, toxicity, or volume of waste; short term effectiveness; implementability; and cost.

Evaluation of Alternative 4E was performed addressing two capping options under the one alternative. The first option was a soil cover system consisting of placement of 1 foot of clay over the excavated material, overlain by 1 foot of topsoil and vegetation. The second option consists of the use of a geomembrane over the waste and overlain by a composite geonet drainage layer and then 4 feet of soil including 6 inches of topsoil. Both options meet all of the corrective action objectives. All of the soil and sediment to be excavated and placed at Area A has been shown to be nonhazardous and are being addressed because USEPA-established action levels for soil (and, indirectly, surface water) have been exceeded for some inorganic constituents. Area A was previously closed in 1981 in accordance with approval from the Ohio EPA. In addition, the Baseline Risk Assessment has indicated that

the existing site conditions do not result in risks of concern outside an industrial setting. As indicated in Section 2.6.3, concentrations of constituents in shallow downgradient monitoring wells are generally below current drinking water MCLs. The potential carcinogenic risk estimate for ingestion of shallow groundwater was determined to be within the acceptable range of carcinogenic risks (1×10^{-4} to 1×10^{-6}) recommended by the USEPA for remediation of CERCLA sites and proposed for the basis of action levels and cleanup standards for RCRA sites. Similarly, the potential noncarcinogenic risk estimate was below the USEPA's acceptable limit of 1.0. Construction of a geomembrane system has been included to address Ohio EPA landfill closure regulations. However, the additional benefit observed by construction of this type of cover system is not significantly improved over that of the soil cover system, especially considering the cost difference. Therefore, the additional cost associated with a geomembrane system is not warranted for this site, and the recommended alternative will include construction of a soil cover system (Option 1).

The specific site areas addressed by this alternative and their boundaries are shown in Figure 6-1. Area boundaries have been determined based upon existing historical data as well as physical structures (i.e., buildings, roads, and ditches) and, in many cases, were extended 5 to 20 feet to provide additional assurance that waste material of concern is being addressed. In particular, this approach has been applied to Area G where a large portion of the waste material is to be removed. These boundaries represent the maximum lateral extent of remedial action; maximum excavation depths have been determined by increasing the associated action level depth, to the next highest 0.5 foot increment, where appropriate. Risk calculations were performed for "residual" constituent concentrations in soil at the various SWMUs (see Appendix E). The "residual risks" were estimated at each of the SWMUs (plus Areas B and C combined) using those remaining soil depths that were not evaluated in the baseline risk assessment (Appendix A). Both the current (and future) industrial worker scenario and the potential future residential adult scenario were evaluated using the same toxicity factors used in the baseline risk assessment. Residual soil risks for lead were not quantified since lead currently has no toxicity value available. Generally, the residual risks are comparable to those calculated in the baseline risk assessment and to background. None of the carcinogenic risks for the current or future scenario exceeded USEPA's lower acceptable limit (1×10^{-4}), nor did any hazard index exceed USEPA's acceptable

limit of 1.0. In addition, none of the residual soil samples exceeded the lead screening level of 400 ppm.

With the approach to establishing area boundaries described above, and the low constituent concentrations detected in the soil at all of the SWMUs (see Section 6 of the RFI), and the results of the risk calculations for residual soil, additional investigatory or confirmatory sampling efforts are not anticipated to be needed for the successful implementation of this corrective measure alternative.

Alternative 4E - Option 1 consists of the surficial (approximately 0.5 feet) excavation of affected soil in Areas B and C, while soil in Area G is excavated to 6.5 feet. Approximately 100 cubic yards of sediment from the drainage ditch segment immediately east of Area B will also be excavated and dewatered prior to disposal. This volume represents an approximate depth of 6 inches over a length of approximately 200 feet. This activity will be preceded by the implementation of surface water controls to eliminate the potential for downstream migration of constituents in the sediment. These controls may include construction of temporary berms to isolate the segment, pumping of surface water flow around those berms, and pumping of any standing water from within the excavation area. The sediment will be air dried prior to placement at Area A. The east one half of on site disposal Area A will be cleared of vegetation and the top 0.5 feet of unaffected topsoil stripped for reuse as final cover in the soil cover system. Erosion control and conservation measures for Area A, stockpiled materials, or any working area will be implemented as necessary to prevent constituent transport or run-on/runoff.

The excavated material (estimated to be 7,850 cubic yards) will then be transported and placed on the eastern most half of Area A, where it will be spread uniformly, compacted, and graded in preparation for the soil cover system. Area G will be first backfilled to within 6 inches; then revegetation of Areas B, C, and G will require a 6 inch layer of topsoil to bring them up to grade, followed by seeding, fertilizing, and mulching of all areas.

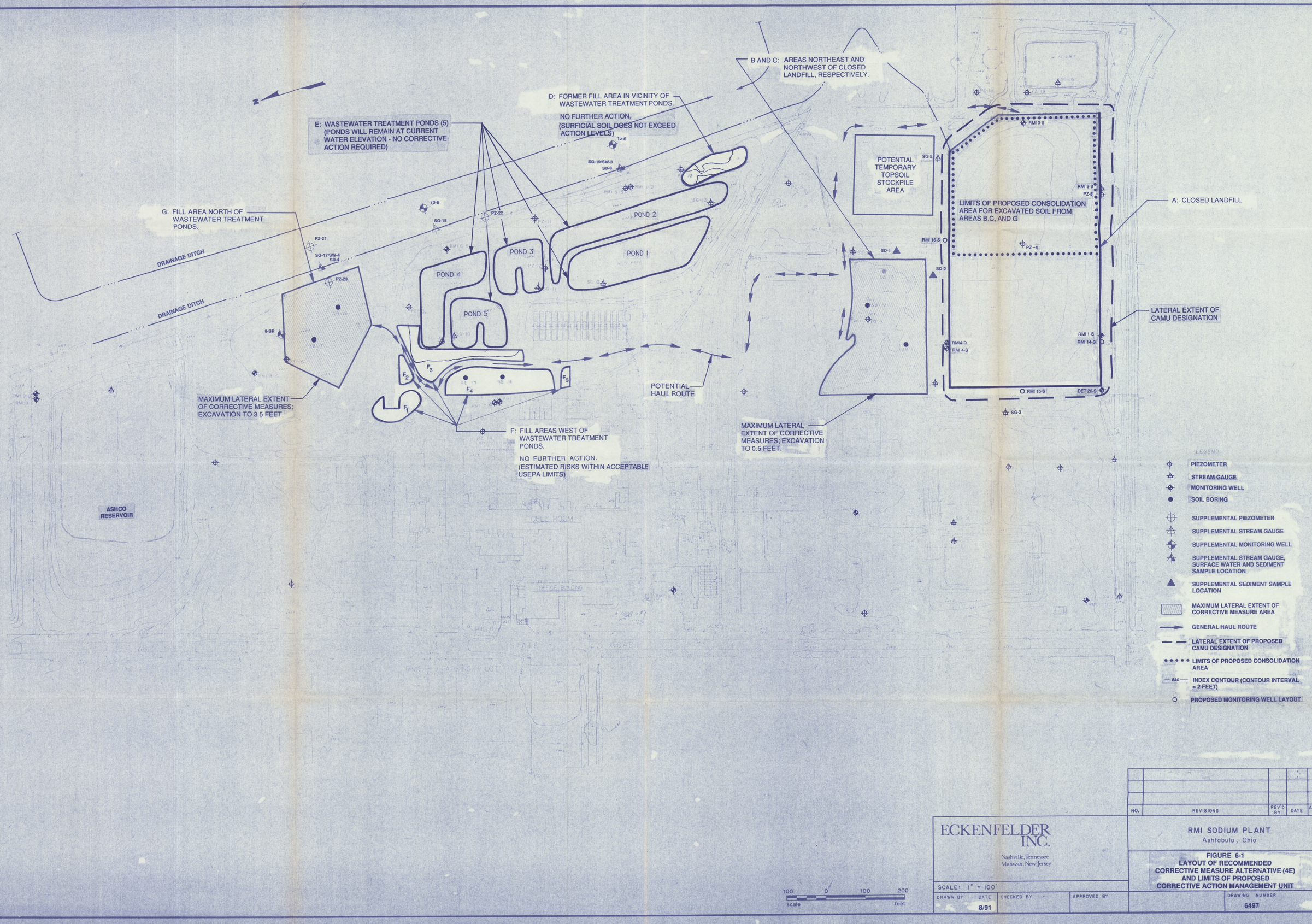
The soil cover system is comprised of the excavated material overlain with a low permeability clay layer. The low permeability clay (1.0×10^{-7} cm/sec) will be placed and compacted in 6 inch lifts to achieve a minimum compacted thickness of 1 foot.

Clay placed in such a manner, at optimum moisture, should not heave or crack, yet will provide self healing properties in the event of waste settlement.

The stockpiled topsoil from Area A will then be replaced at Area A. Topsoil used for revegetation of Areas B, C, and G, in addition to the final cover at Area A, should be characteristic of productive topsoil in the region. The topsoil needed for final cover at Area A should be readily available to make up the additional depth to provide a minimum 1 foot layer. The topsoil should be placed uncompacted. Grass seed should be a common mix commercially available in the Ashtabula region.

Implementation of these corrective measures is not expected to impact the DNAPL existing beneath Area A because the DNAPL is deeper than the bottom of the landfill and existing fill in Area A will not be disturbed. This DNAPL has been determined to be originating off site south of the RMI Sodium Plant. This determination is supported by a report regarding potential sources of contamination at the Fields Brook Superfund Site. The report, entitled "Fields Brook Source Control Operable Unit Remedial Investigation Report" (Woodward-Clyde, 1992), identifies the facility immediately adjacent to the southern RMI property boundary as producing organic solvent materials over the years. This facility is reported to have utilized several surface impoundments as settling ponds. All of these lagoons were located in the northeast portion of that property (immediately south of the RMI landfill).

O&M requirements for Area A will include routine inspection, watering, revegetation, and mowing of the vegetative cover, prohibiting woody vegetative growth, and any general repair to the cover system associated with abnormal settlement, heavy seasonal rainfall events, freeze/thaw events, or burrowing animals. Existing and proposed new groundwater monitoring wells will be utilized to monitor the effectiveness of the corrective measure. Wells 3-S and 4-S and proposed new wells 14-S, 15-S, and 16-S (ECKENFELDER INC., 1995) will be monitored semiannually for a period of three years. The wells will be sampled and analyzed for a focused parameter list (e.g., pH, TSS, Ba, and Cd). At the end of the three year period, the data will be statistically evaluated to determine whether or not continued monitoring is required based on consistent or decreasing constituent concentrations. If monitoring is required for more than the initial three years, the data will be reevaluated. This will continue until results indicate that monitoring is



NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey

RMI SODIUM PLANT
Ashtabula, Ohio

FIGURE 6-1
LAYOUT OF RECOMMENDED CORRECTIVE MEASURE ALTERNATIVE (4E) AND LIMITS OF PROPOSED CORRECTIVE ACTION MANAGEMENT UNIT

SCALE: 1" = 100'			
DRAWN BY	DATE	CHECKED BY	APPROVED BY
	8/91		

DRAWING NUMBER 6497

no longer required. No monitoring of the unsaturated zone and no run-on or run-off monitoring are necessary. Site security is expected to continue in a capacity similar to past operation. A notice will be placed in the deed to the property which indicates the status of Areas A, D, and F. This notice will place restrictions on the future use of these areas.

For implementation of this recommended corrective measure, RMI proposes designation of a single land-based CAMU. This proposed designation is required to be approved by the USEPA and Ohio EPA at which time it will then be incorporated into the RMI Sodium Plant RCRA permit. The boundaries of the proposed CAMU are identified on Figure 6-1, and encompass the area around Area A. Selection of the boundaries for the proposed CAMU is based on the results of the RFI, the results of the evaluation of potential corrective measures performed in this CMS, and the requirements for CAMUs set forth in 40 CFR 264.552. As specified at 40 CFR 264.552(a) and discussed in Section 3.3, placement of remediation wastes into or within this CAMU will not constitute land disposal of hazardous waste, and consolidation of wastes within this CAMU will not require RMI to meet all minimum technology requirements.

Consideration has been given to the requirements of 40 CFR 264.552(c) in proposing this CAMU. These requirements and the manner in which RMI proposes to meet them are summarized in Table 6-4. In general, the recommended alternative includes excavation and on site disposal; no treatment is anticipated and temporary units will not be utilized. The recommended alternative is a reliable, effective, protective, and cost-effective remedy. Excavation and on site disposal is a proven reliable technology. Based on the results of the HEA and the Baseline Risk Assessment, none of the material to be excavated poses a significant human health or environmental concern; therefore, consolidation of this material and placement under a soil cover provides additional effective protection. Consolidation also allows the minimization of the land area upon which wastes will remain in place after closure, thus reducing the post-closure escape of constituents of concern. Consolidation also minimizes the need for further maintenance. Uncontaminated areas of the site have generally not been included within the proposed CAMU; placement or disposal of wastes onto uncontaminated areas is not a part of the recommended alternative. Since implementation of the recommended alternative would occur entirely on site, unacceptable risks to humans or the environment will

TABLE 6-4

SUMMARY OF DECISION CRITERIA FOR PROPOSED CAMU DESIGNATION

RMI SODIUM PLANT
ASHTABULA, OHIO

Decision Criterion[a]	How Recommended Alternative Meets Criterion
Facilitation of Reliable, Effective, Protective, and Cost-Effective Remedy	As discussed in Section 6.3, in general, the recommended alternative includes stripping and temporary storage of topsoil from Area A; excavation of soil from Areas B, C, and G and sediment from the drainage ditch adjacent to Areas B and C, followed by direct placement onto Area A; and construction of a low permeability soil cover over Area A with replacement of the stockpiled topsoil. The material to be excavated includes approximately 7,850 cubic yards of wastes, soil, and sediment with low concentrations of inorganics (e.g., arsenic, cadmium, and lead). Additional information on the types and concentrations of the wastes and waste constituents is provided in the approved RFI Report and the Supplemental RFI Report (summarized in Section 1 of the CMS Report), and Section 3. Excavation and placement of a low permeability soil cover are proven reliable technologies. The HEA (Section 2) and Baseline Risk Assessment (Appendix A) showed that there are no receptors and no significant potential risks; therefore, placing waste material under a low permeability cover will increase protectiveness. The selected remedy has been shown to be one of the least costly alternatives evaluated during the CMS (see Table 6-3).
Risks During Remediation	The HEA and the Baseline Risk Assessment have shown that there are no receptors and no significant potential risks associated with this site. The site is located in a sparsely populated, primarily industrial area. Implementation of the recommended alternative will occur entirely on site, well within RMI property boundaries. Handling of contaminated material will be minimal and will involve excavation and direct placement of material onto Area A (no temporary stockpiling of waste material is expected). Short-term concerns identified include dust production, erosion, surface water run-off, and safety issues; all of these will be properly addressed during remedial design and implementation of control measures.
Uncontaminated Areas	The boundaries of the proposed CAMU are shown on Figure 6-1 and include minimal uncontaminated land, only in the immediate vicinity of Area A. No other uncontaminated land on which remediation waste management will occur is included in implementation of the recommended alternative. Excavated material will be placed directly atop Area A after excavation. The only temporary stockpile area is for uncontaminated topsoil from Area A, which will be replaced. The only other areas involved in the corrective measure include existing plant roadways to be used as temporary haul routes. No temporary units or regulated units are included in the proposed CAMU.
Minimizing Future Releases	By consolidating waste materials on site and placing more waste material under a low permeability cover, the potential for future releases has been significantly reduced. While more waste material will be placed atop Area A, it will be placed between two low permeability soil covers, and it is not a hazardous waste. Therefore, placement of this material on Area A will not reduce the existing protectiveness of Area A.

TABLE 6-4 (Continued)

SUMMARY OF DECISION CRITERIA FOR PROPOSED CAMU DESIGNATION

RMI SODIUM PLANT
ASHTABULA, OHIO

Decision Criterion[a]	How Recommended Alternative Meets Criterion
Timing	No innovative technologies are included in the recommended alternative; however, designation of a CAMU will result in no minimum technology requirements becoming effective. This will allow placement of a low permeability soil cover that may not be considered best available technology (but that has been shown to be adequately protective). This will, in turn, substantially decrease the time required to complete implementation of the corrective measures. A proposed schedule for implementation of the recommended alternative is included in Section 7.
Enhancing Long-Term Effectiveness	Waste materials will not be treated as part of the recommended alternative. Treatment technologies suitable for the type of constituents present at the site (low concentration inorganics) would minimally reduce mobility, but increase volume. Placement of waste materials under a low permeability soil cover will also reduce mobility without increasing volume. Existing groundwater monitoring data in the vicinity of Area A have shown no degradation of the shallow water-bearing zone. Continued monitoring of the shallow water-bearing zone will consist of semiannual monitoring of existing wells 3-S and 4-S, and new proposed wells 14-S, 15-S, and 16-S in the vicinity of Area A. Monitoring of the unsaturated zone or of run-on and run-off will not be necessary. There will be no additional post-closure maintenance beyond what is currently in place (i.e., inspection and repair of the existing soil cover).
Minimizing Land Areas Where Wastes Will Remain in Place	In this CAMU approach, soil from Areas B, C, and G (123,300 square feet) will be consolidated over a portion of Area A (100,000 square feet). This represents an approximately 20 percent reduction in land area. In addition, it eliminates the contaminated material from Areas B and C. There will be significant consolidation of wastes and placement of wastes under a low permeability cover at Area A. In addition, the waste material to be excavated includes soil with some of the higher concentrations of constituents of interest. The soil that will remain in place has been shown to present minimal potential risk and, in fact, risk estimates approach those of background conditions (see Appendix E). The lateral extent of Area A will be neither increased nor decreased; only a portion of the landfill will be raised. Post-closure maintenance and monitoring will be the same for Area A after implementation of the recommended alternative as it is now.

[a]As provided in 40 CFR 264.552(c).

be minimized. Further, designation of the proposed CAMU will allow the flexibility necessary during implementation of the corrective measure, thereby facilitating a more expeditious remedy which, in turn, provides cost effectiveness.

Overall, the proposed CAMU designation would provide RMI the necessary flexibility required for on site management of wastes that have been demonstrated, for the most part, to pose no significant risks or exposure hazards. The proposed CAMU designation is uniquely suited for the RMI Sodium facility due to the similar nature of wastes and the close proximity in which individual SWMU areas are located with respect to each other. There is no need to designate additional SWMUs as part of the CAMU since soil with concentrations above action levels will be removed from Areas B, C, and G, and material can be moved into a CAMU without triggering MTRs or LDRs. Based on these considerations, RMI feels that the information required by 40 CFR 264.552(d) and specified in 40 CFR 264.552(e) has been provided, which will allow the USEPA and the Ohio EPA to designate the proposed CAMU through modification of the existing RCRA permit.

The total present worth of Alternative 4E - Option 1 is estimated at $675,000. Total annual operating and maintenance costs are estimated at $19,000. A summary and development of these costs are provided in Table 6-3. RMI will establish a financial mechanism for the Sodium Plant similar to that for other RMI facilities to provide continuous compliance with financial assurance requirements as part of the permit modification for the Sodium Plant. Financial assurance will be provided for an amount at least equal to the cost estimate provided in this CMS.

Implementation of these corrective measures will significantly reduce any risks associated with the existence of site constituents in site media. This alternative consists of removal of waste sources at Areas B, C, G, and within the drainage ditch, and consolidation and capping of affected material. These corrective measures are expected to result in the continued observation of decreasing constituent concentrations in the site shallow groundwater, thereby reducing the potential for future exposure to groundwater contamination by on site or off site receptors.

7.0 PROJECT SCHEDULE

A proposed Project Schedule, presented in Table 7-1, has been developed for approval and implementation of the final CMS. In addition to the anticipated implementation requirements of the recommended alternative, proposed 40 CFR 264, Subpart S (Corrective Action for Solid Waste Management Units; Federal Register 1990) has been considered in the preparation of the schedule. In particular, proposed sections 264.525(c) and sections 264.526 - 264.531 would be applicable if Subpart S were promulgated. Previously, in the Draft CMS, Project Milestones were scheduled to provide for the expeditious remediation of the RMI site. However, substantial time has elapsed since submittal of the Draft CMS Report. The following schedule is presented to reflect the actual dates of Project Milestones attained and the anticipated timing for implementation of the CMS.

1. **Submittal of Draft CMS to USEPA, Region V.** In accordance with the CMS Plan (revised pursuant to USEPA comments and submitted on August 19, 1991), the Draft CMS was prepared and submitted on August 27, 1991.

2. **USEPA Review and Comment; Submittal of Final CMS to USEPA.** Initial USEPA comments on the Draft CMS were received by RMI on January 11, 1993. In accordance with the USEPA letter transmitting comments on the Draft CMS, RMI revised the CMS and submitted the Final CMS to USEPA on March 10, 1993.

3. **Submittal of Revised Final CMS to USEPA.** Additional USEPA comments were received by RMI on June 13, 1994, which included a request to conduct a baseline risk assessment. In a later meeting (July 28, 1994) to discuss these comments, the date for resubmittal of the CMS was set at September 15, 1994. Response to comments, document modifications, and the baseline risk assessment were submitted on the required date as part of the revised Final CMS.

4. **Submittal of Revised Final CMS to USEPA.** Further USEPA comments were received by RMI on March 3, 1995. Based on later telephone conversations between RMI and the USEPA, the date for

TABLE 7-1

PROPOSED PROJECT SCHEDULE
SITE REMEDY IMPLEMENTATION

RMI SODIUM PLANT
ASHTABULA, OHIO

	Project Milestone	Anticipated Completion Date
1.	Submittal of Draft CMS to USEPA, Region 5	August 27, 1991
2.	a. RMI receipt of USEPA first Review and Comments	January 11, 1993
	b. RMI submittal of Revised CMS to USEPA, Region 5	March 10, 1993
3.	a. RMI receipt of USEPA second Review and Comments	June 13, 1994
	b. Submittal of Revised Final CMS to USEPA, Region 5	September 15, 1994
4.	a. RMI receipt of USEPA third Review and Comments	March 3, 1995
	b. Submittal of Revised Final CMS to USEPA, Region 5	May 12, 1995
5.	USEPA Review and Approval of Revised Final CMS Report	June 12, 1995
6.	CMS Approval Process	
	RCRA Permit Revision by the USEPA, Statement of Basis	July 3, 1995
	Public Review and Comment	August 14, 1995
	Preparation of Final (Modified) Permit	October 2, 1995
7.	Corrective Measure Design and USEPA approval	March 4, 1996
8.	Corrective Measure Construction	November 1, 1996

resubmittal of the CMS was set at May 12, 1995. The response to comments and CMS document modifications were submitted on the required date.

5. **USEPA Review and Approval of Revised Final CMS Report.** A typical 30 day Agency review and approval period has been provided. However, as stated previously, RMI has worked closely with the Agency on this project and, therefore, prefers a shorter review and approval period to expedite implementation of corrective measures.

6. **CMS Approval Process**. It is anticipated that approval of the CMS will, essentially, be a three step process. As discussed in proposed 40 CFR sections 264.525(c) and 264.526, the current facility RCRA permit will be revised to indicate the preliminary remedy selection. If promulgated, proposed regulations would require the Agency to include a Statement of Basis (similar to the Record of Decision under Superfund) in the draft permit modification. As provided under proposed Section 264.526, the draft permit would be issued for a 45 day public review and comment period. Based on public review and comment, an approved final modified RCRA permit would be issued by the Agency to RMI. As indicated by the Proposed Project Schedule, these project activities are anticipated to require approximately 16 weeks from approval of the Final CMS.

7. **Remedial Design**. To assure that Corrective Measure Construction (CMC) begins in the 1996 construction season, the Corrective Measure Design (CMD) preparation and review process must be scheduled such that the contract for remedial construction is awarded in early 1996. This will require the CMD bid and contract documents to be prepared, approved by the Agency, and bid to approved remedial contractors by that date. Considering the relatively straightforward nature of remedial concerns at the RMI site, it is proposed the CMD phase consist of a Preliminary CMD Report and Final CMD for Agency review and approval. The Preliminary CMD Report would include a description of the remedial design components which are required by the final modified permit. No detailed design drawings or specifications would be submitted with the Preliminary CMD Report. Monthly progress reports would be submitted to inform the

Agency of progress or any problems encountered during the CMD. The Final CMD would include all detailed plans and specifications and other components (such as the remedy operation and maintenance plan) required by the final modified permit. Preparation of the CMD in this manner will ensure the expeditious implementation and completion of the selected remedy.

8. **Remedial Construction**. It is anticipated that CMC can be successfully completed in approximately three months. The overall time required for implementation of the remedy and Agency determination that the conditions of the final modified RCRA permit have been met is anticipated to require up to eight months. As such, the date for Agency approval of remedy compliance with the final modified permit is November 1, 1996.

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FINAL
CORRECTIVE MEASURES STUDY
RMI SODIUM PLANT
ASHTABULA, OHIO
OHD 000 810 242
March 1993
Revised September 1994
Revised May 1995

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EXECUTIVE SUMMARY

This appendix to the draft final Corrective Measures Study (CMS) report presents the baseline (i.e., no action) risk assessment for the RMI Sodium Plant in Ashtabula, Ohio. The risk assessment presented here consists of a full quantitative human health risk assessment, performed for soils for the constituents, depths, and areas of interest at the RMI Sodium Plant, as requested by the USEPA (see Attachment I).

Section A1.0 (Introduction) discusses the regulatory history at the RMI Sodium Plant and outlines the documents which have been generated for the facility leading up to the preparation of the draft final CMS report. Also discussed are the previous submittals of a Health and Environmental Assessment (HEA) and RCRA Facility Investigation (RFI) by RMI for the facility.

In Section A2.0 (Exposure Assessment), the constituents, soil depths, and areas of interest for the risk assessment are presented. The areas and constituents of interest are a result of a comparison of site soil data to background levels during the RFI, as well as a comparison to USEPA action levels for the site. In Section A2.0, site data relevant to the risk assessment, the calculation of exposure point concentrations, the evaluation of exposure scenarios, and the quantification of potential exposures are also presented. Potential receptor populations under both current and future scenarios were considered. Since the facility is located in a highly industrialized area and site access is restricted by means of a chain-link fence and 24 hour-a-day security guards, only the industrial worker population was evaluated under the current scenario. Two future scenarios for the site were considered: (1) conditions remain essentially the same as the current situation (i.e., the site remains industrial), and (2) the site undergoes residential development. Although RMI considers future residential development of the site to be unlikely, the USEPA required that it be evaluated. Therefore, under the future scenario, both residential and industrial populations were assumed.

Toxicity factors associated with the constituents of interest at the RMI Sodium Plant, which were used in the quantification of risks, are presented in Section A3.0 (Toxicity Assessment). Section A4.0 (Risk Characterization) presents the risk estimates calculated for the potential current and future receptor populations evaluated. Carcinogenic and noncarcinogenic risks were calculated separately for

each of four of the five areas of interest at the RMI Sodium Plant (Areas B, C, F, and G), as well as for Areas B and C combined (as the areas were combined in the draft final CMS report), and for background soils. Risks were not quantified for Area D since no toxicity data are currently available for lead, the only constituent of interest in Area D.

For the current scenario, the total carcinogenic risk estimates ranged from 1.5×10^{-5} (Area F) to 1.6×10^{-5} (Areas B, C, Areas B and C combined, and G). The highest current carcinogenic risk estimates (1.6×10^{-5}) were principally driven by both the dermal contact and incidental ingestion exposure routes, of which arsenic was the sole risk contributor. The total carcinogenic risk estimate for background soil was 1.2×10^{-5}.

The total noncarcinogenic hazard indices for the current scenario ranged from 0.077 (Area F) to 0.85 (Area B and Areas B and C combined). The highest current hazard index (0.85) was driven by both dermal contact and incidental ingestion exposure routes, of which cadmium was the primary risk contributor. The hazard index for background soil was 0.066.

For the future scenarios, total carcinogenic risk estimates ranged from 3.7×10^{-5} (Area F) to 3.9×10^{-5} (Areas B, C, Areas B and C combined, and G). The highest total carcinogenic risk estimates (3.9×10^{-5}) were primarily driven by both dermal contact and incidental ingestion exposure routes, of which arsenic was the sole risk contributor. The total carcinogenic risk estimate for background soil was 2.9×10^{-5}.

The total noncarcinogenic hazard indices for the future scenarios ranged from 0.16 (Area F) to 1.7 (Areas B, and Areas B and C combined). The highest noncarcinogenic hazard index (1.7) was driven by the incidental ingestion and dermal contact exposure routes, of which cadmium was the primary risk contributor. The hazard index for background soil was 0.13.

Several of the risk estimates, including those for background soils which are remote from and unaffected by the solid waste management units (SWMUs) at the RMI site, are controlled largely by the presence of arsenic. This is not particularly surprising based upon the results of other studies of background soils concentrations in the Fields Brook drainage basin. The arsenic concentrations measured during the

Sodium Plant RFI are in the range of those measured at other locations near Fields Brook. RMI has identified four possible explanations for the presence of arsenic: 1) its natural presence in soils; 2) pesticide use during previous farming in the area; 3) the nearby Elkem ferrosilicon plant air emissions; and 4) the nearby coal-burning power plant air emissions.

Considering all of the total estimated carcinogenic risks for both the current and future scenarios, including risk estimates for background soil, none of the total estimated carcinogenic risks for either the current or future scenarios exceeded the upper limit of USEPA's acceptable range (1×10^{-4}). Two future noncarcinogenic hazard indices exceeded USEPA's acceptable limit of 1.0: potential residential exposure to surficial soils from Area B and potential residential exposure to surficial soils from Areas B and C combined. (Note: the combined area exceeded the limit because Area B exceeded the limit). With the exceptions of these two risk estimates, all of the remaining total noncarcinogenic hazard indices were below USEPA's acceptable level of 1.0.

As discussed in Section A3.0, there is no currently accepted toxicity value for lead, and thus risks for lead were not quantified. The USEPA agreed, therefore, to use the recently released CERCLA/RCRA lead screening level for residential soils (400 ppm) to evaluate the concentrations of lead in soil in the areas of interest at the RMI Sodium Plant. The only soil sample which exceeded this value was collected from Area B, 0 to 4 inches (SS3-3, 1,140 ppm).

The risk estimates for the SWMUs should also be considered in conjunction with those calculated for the background soils. First, it is clear that the background risk estimates present the absolute lower performance bound of any possible cleanup activities at the site, and thus cleanup to a one in one million (1×10^{-6}) risk level would be impossible. Second, with the exception of the hazard indices for Area B, all of the potential risks are very close to background conditions, and corrective measures for the other SWMUs would offer only marginal enhancement of protection of human health. Finally, the only risk estimates which exceed USEPA's acceptable values are for a speculative future residential development on a long-standing industrial property, and therefore, from the perspective of protecting human health, there are no compelling reasons to undertake any sort of corrective measures for soils in SWMUs at the RMI Sodium Plant. However, even though the

only calculated risk value that exceeded allowable USEPA limits was for total noncarcinogenic hazard indices for the speculative future residential scenario (maximum hazard index of 1.7), the CMS has evaluated remedial alternatives that would lead to a reduction of potential health risks presented by the current contaminant levels found in site soils.